REMARKS

CLAIMS CHART COMPARISON

The 13 claims that are identical in Zimmermann patent # 6,546,796 and my application # : 10/736,116

My claim # 16 is identical to claim # 1 in patent # 6,546,796

Here is the identical claim :

16.(Amended) A liquid level sensor comprising:

a substrate having a longitudinal axis;

a first plurality of thermocouples provided on one side of said substrate in longitudinally spaced relationship;

a second plurality of thermocouples provided on said one side of said substrate in longitudinally spaced relationship to each other, respective ones of said second plurality of thermocouples being positioned in laterally spaced relationship to respective ones of said first plurality of thermocouples;

said first and second thermocouples being interconnected in alternating series relationship;

a heat source for increasing the temperature of each of said first plurality of thermocouples;

a heat sink positioned in heat transfer relationship to said plurality of second thermocouples;

said sensor being adapted to be positioned within a vessel containing a volume of liquid with said substrate partially immersed in said liquid such that said first and second plurality of thermocouples will cooperate to generate a signal indicative of the level of liquid within said vessel.

My claim # 31 is identical to claim # 2 in patent # 6,546,796

Here is the identical claim :

31.(New) A liquid level sensor as set forth in claim 16 wherein said second plurality of thermocouples are operative to generate a compensating signal indicative of ambient temperature.

My claim # 17 is identical to claim # 3 in patent # 6,546,796

Here is the identical claim :

17.(Amended) A liquid level sensor as set forth in claim 31 wherein said first plurality of thermocouples generates a signal of a first polarity and said second plurality of thermocouples generate a signal of opposite polarity.

My claim # 18 is identical to claim # 6 in patent # 6,546,796

Here is the identical claim :

18.(Amended) A liquid level sensor as set forth in claim 16 wherein said sensor includes third and fourth serially connected thermocouples operative to generate a signal indicative of a pressure within said vessel.

My claim # 20 is identical to claim # 10 in patent # 6,546,796

Here is the identical claim :

20.(Amended) A liquid level sensor as set forth in claim 16 wherein said signal from said thermocouples is supplied to signal conditioning circuitry.

My claim # 32 is identical to claim # 11 in patent # 6,546,796

Here is the identical claim :

32.(New) A liquid level sensor as set forth in claim 20 wherein said signal conditioning circuitry includes an amplifier.

My claim # 33 is identical to claim # 16 in patent # 6,546,796

Here is the identical claim :

33.(New) A liquid level sensor comprising:

a substrate having a longitudinal axis;

a first plurality of thermocouples provided on one side of said substrate in longitudinally spaced relationship;

a second plurality of thermocouples provided on said one side of said substrate in longitudinally spaced relationship to each other, respective ones of said second plurality of thermocouples being positioned in laterally spaced relationship to respective ones of said first plurality of thermocouples;

said first and second thermocouples being interconnected in alternating series relationship;

a heat source for increasing the temperature of each of said plurality of first thermocouples; and

a heat sink provided on said substrate in close proximity to said second plurality of thermocouples;

said sensor being adapted to be positioned within a vessel containing a volume of liquid with said sensor partially immersed in said liquid such that said first and second thermocouples cooperate to generate a signal indicative of the level of said liquid within said vessel.

My claim # 34 is identical to claim # 18 in patent # 6,546,796

Here is the identical claim :

34.(New) A liquid level sensor as set forth in claim 33 wherein each of said first plurality of thermocouples generate a first magnitude signal when positioned at a level above the surface of said liquid and a second magnitude signal when positioned at a level below said surface of said liquid, the sum of said first and second magnitude signals being indicative of the level of said liquid within said vessel.

My claim # 35 is identical to claim # 19 in patent # 6,546,796

Here is the identical claim :

35.(New) A liquid level sensor as set forth in claim 34 wherein said second plurality of thermocouples generate a signal indicative of the ambient temperature within said vessel.

My claim # 36 is identical to claim # 21 in patent # 6,546,796

Here is the identical claim :

36.(New) A liquid level sensor as set forth in claim 33 wherein said heat sink is provided on said substrate on a side of said substrate that is opposite said one side of said substrate.

My claim # 37 is identical to claim # 22 in patent # 6,546,796

Here is the identical claim :

37.(New) A liquid level sensor as set forth in claim 33 further comprising a thermally conductive electrically insulating coating encapsulating said sensor.

My claim # 38 is identical to claim # 23 in patent # 6,546,796

Here is the identical claim :

38.(New) A liquid level sensor as set forth in claim 37 wherein said coating is operative to shed droplets of said liquid.

My claim # 39 is identical to claim # 24 in patent # 6,546,796

Here is the identical claim :

39.(New) A liquid level sensor as set forth in claim 33 wherein said heat source comprises an elongated resistance heater.

WHY I WILL PREVAIL ON THE PRIORITY

I will prevail on the priority for the following reasons :

1) The director of technology, Mr. Kahdkikar, to whom Mr. Zimmermann reports, admitted in his depositions (A copy of two pages from his depositions is shown in Appendix A) that Thermodisc, did not have the technology of measuring continuous liquid level before I disclosed it to Thermodisc. More specifically Thermodisc and Zimmermann never had the technology of measuring continuous liquid level with a heater and thermocouples and how to make it work until I disclosed it to Thermodisc.

2) Thermodisc authorized manager signed my non-disclosure agreement in December 1997. Prior to that time, Thermodisc never had the technology of measuring continuous liquid level with a heater and type T thermocouples and using the other features described in the claims. A copy of the non-disclosure agreement is shown in Appendix B.

3) In June 1998, Mr. Zimmermann planned to send a letter to a company (Sheldahl) , in which it was written that some aspects of the technology described in this patent are proprietary of Thermodisc. I requested from Mr. Zimmermann's manager, Mr. Kahdkikar that he removes the claim of proprietary and put confidential since I was the inventor of the technology described in the drawings that he sent to other companies. Mr. Zimmerman complied. (See Appendix C)

4) From December 1997 to August 1999, I advised Mr. Zimmermann on how to design and manufacture the continuous liquid level measurement method and apparatus

described in his patent. I have about 80 pages of technical information that I supplied to him and his letter asking for technical help. Enclosed in appendix D, are two samples of the technical letters that I sent to Thermodisc.

5) Calculating the continuous liquid level by the use of temperature profile along a heater using low-power and low-cost materials was invented by me before I disclosed it to Thermodisc. Mr. Zimmermann disguised the use of temperature profile in his patent by not calling it a temperature profile and just using figure 3 in his patent. Figure 3 in Mr. Zimmermann patent is easily obtained from Figure 3 of my patent application and my previous patents by adding the voltage reading in my Figure 3, from all of the thermocouples for each point of the liquid level. For example, if Zimmermann Figure 3 was obtained for 6 thermocouples, then the adding the voltage (Emf) corresponding to temperature rise , in my Figure 3, when all 6 thermocouples are in liquid [i.e. 6 times the value of line 56 in my figure 3] will give the same voltage as the voltage for level 0.0 in Figure 3 of Mr. Zimmermann. Similarly, if all 6 thermocouples are in air, taking six time the EMF corresponding to line 55 in my Figure 3 will give the point of maximum EMF in Figure 3 of Mr. Zimmerman. All of the Intermediate points on Figure 3 of Mr. Zimmerman patent will be obtained similarly by adding the corresponding emf from the six thermocouples in my Figure 3. In other words, all that Mr. Zimmermann did, was using my Figure 3 and just adding the voltage readings from all thermocouples to get his Figure 3. [see Appendix E for Mr. Zimmermann Figure 3 and Figure 3 of my application]

6) From the time that Thermodisc signed my non-disclosure in December 1997, until August 1999, I supplied technical information on my technology to Thermodisc and mostly to Mr. Zimmermann. Moreover, every time that Mr. Zimmermann could not move forward technically to complete the productization of my technology or makeaprototype worked, he contacted me and asked me to figure out why his productized version of the sensor did not work. In one of those cases, he could not make the sensor work properly in measuring oil level in compressors. He requested in writing (A copy of his request is shown in Appendix F) that I evaluate the test data and offer a solution to the technical problem that he encountered.

CLAIMS CHART IN THE SPECIFICATIONS

In this amendment, I am amending my claims as well as prepared an explanation on where those claims are shown in my specifications. Hence, the technical basis for the similarity between the claims of patent 6,546,796 and my patent application 10,736,116.

New claims Support in the Specifications of patent application # <u>10/736,116.</u>

Amended claim 16 Remarks :

Mr. Zimmermann in his patent uses this claim to say that if one uses a heater and a set of thermocouples to measure the temperature rise along the heater after power is applied to it and then use his Figure 3, the continuous liquid level can be measured.

Those three items of first Figure 3, second a heater and third thermocouples as well as the required relationship between them for the sensor to measure continuous liquid level are shown in my specifications.

First, Figure 3 of Mr. Zimmermann. If one looks at my table 2 and add the temperature rise in thermocouples Tc1, Tc2, Tc3, Tc4.,Tc5 and Tc6 after power is applied to them and add all six thermocouple rise, Figure 3 of Mr. Zimmermann patent will be automatically generated. Another way of getting Figure 3 in Mr. Zimmermann patent is to take the temperature rise in different adjacent thermocouples after power is applied, off figure 3A in my application and add those temperature rise.

Second, the heater design. The cross-section of the heater need to be such that heat is transferred from the heater to the liquid and the medium above it in a way that some of the heat is also stored in the heater and transferred along the heater. In other words, the heat from the heater flows radially as well as axially. The axial heat flow between two thermocouples will indicate where the continuous liquid level is located between two adjacent thermocouples. For this to happen, the heater cross-section must be selected accordingly. Moreover, this needs to happen with low power. This is how I got the temperature profile of Figure 3A in my application. Instead of saying that he uses a temperature profile along heater designed based on the technical information that I used in my patent application , and adding the reading from the thermocouples along such a heater , Mr. Zimmermann just uses his Figure 3 to determine the continuous liquid level and does not call it a temperature profile.

In Figure 6 of my application, I use such a heater element 62 mounted on a substrate 63 and being heated by a power source element 90.

Third, the thermocouples that are used to measure the temperature rise along the heater after power is applied to the heater. Besides thermocouples, many other types of temperature sensors can be used to measure the temperature rise along the heater after power is applied to it. I used type T thermocouples [i.e. one leg is made of Constantan and the other is made of Copper] since the voltage readings from such a low-cost thermocouples is stable over a wide range of operating temperature and thus will not

require calibration to read accurately the temperature rise along the heater. Moreover, I used those thermocouples in a parallel configuration instead of serially connected thermocouples with a Copper heat spreader [or what Mr. Zimmermann mistakenly called a heat sink strip 60 in his Figure 2] connecting all of the cold to equalize the temperature of all the cold junctions. The advantage of using the parallel thermocouple configuration is that a single cold junction is used for referencing the rise of all of the hot junctions. In contrast, if the cold junctions in Mr. Zimmermann do not have the same temperature before power is applied then the voltage reading of his thermocouple configuration will be erroneous. For example, let us say that prior to applying power, cold junctions 1 through 4 read 20 degree C and cold junction 5 and 6 read 22 degree C. Then we apply power. To get the voltage rise of hot junction 1 through 4, the voltage from those junctions will be subtracted from the voltage corresponding to 20 degree C while the voltage of hot junctions 5 and 6 will need to be subtracted from the voltage corresponding to 22 degree C. This is why the cold junctions temperature in serially connected configuration must be close to each other. One efficient way of achieving it is to connect all of the cold junctions inside of an isothermal block which is a lot more efficient than the heat spreader [Copper strip element 60 in Figure 2 of Mr. Z\immermann]

In figure 6 of my application, there is a Copper wire [trace] that goes from the top of the Constantan strip 60 to the microprocessor element # 81. The junction between the top of the Constant and the Copper is where the cold junction in my parallel

thermocouple configuration used to measure the temperature rise along the heater after power is applied to it.

The voltage in the cold junction in Figure 6 of my application is going from Copper to Constantan and then in the hot junctions between the Copper traces 71 to 80 and the Constantan strip 60, the voltage goes from Constantan to Copper. Thus when the microprocessor element 81 connect the Copper trace of the cold junction to the Copper trace of any hot junction, it automatically gives the voltage rise in the hot junction relative to the cold junction after power is applied to the heater.

To sum it up, in Figure 6 of my application, substrate 61 is used to mount the thermocouples on it. In Figure 1 of my application, shows this substrate is mounted along a longitudinal axis of a vessel.

First [Hot] plurality of Thermocouples [71 to 80 in Figure 6 of my application] are provided on one side of substrate 61 in longitudinally spaced relationship.

Instead of cold junctions connected thermally by a heat sink to have the temperature [voltage] of all cold junctions equal, in Figure 6 of my application, I just used a single cold junction without a need for a heat sink whose function is really to spread the heat between the cold junctions to equalize the temperature of all of the cold junctions. I also mentioned in my application on page 12 , 9 lines from the top, that the thermocouples

configuration can be serially connected if the hot junction are placed under the heater. While Heat source 90 in Figure 6 of my application is shown.

In Figure 1 of my application, the sensor [element 20 which include the substrate] is being adapted to be positioned within a vessel [element 10 in figure 1 of my application] containing a volume of liquid with said substrate partially immersed in said liquid such that the plurality of hot junction with either a single cold junction or a plurality of cold junctions connected by isothermal block will cooperate to generate a signal indicative of the level of liquid within said vessel.

New claim 31 Remarks :

To get the temperature rise of the hot junctions after power is applied, the voltage from the hot thermocouple junctions need to be subtracted from the voltage of the cold thermocouple junctions. If the ambient temperature is equal to the temperature of the cold junctions in a serially connected thermocouples , then and only then the cold junctions will generate a compensating signal indicative of ambient temperature. If the cold junction temperatures is significantly different than the ambient temperature, then the cold junction will not generate a compensating voltage indicative of ambient temperature.

Amended claim 17 Remarks :

In Figure 6 of my application, by having the cold junction going from Copper to Constantan and the hot junction going from Constantan to Copper, the hot and cold junctions will generate a voltage of opposite polarity.

Amended claim 18 Remarks :

By using the voltage of any of the hot thermocouple junctions that is far away from the liquid level relative to the voltage of the single cold junction in Figure 6 in my application, I will get a signal indicative of a pressure within a sealed vessel. This is true only if the pressure in the air above the liquid is uniform and the air temperature is uniform.

Amended claim 20 Remarks :

In Figure 10 of my application, the signal from the thermocouples is sent to a signal conditioning circuitry.

New claim 32 Remarks :

In Figure 10 of my application, I used a differential amplifier element 96.

New claim 33 Remarks :

This claim is almost identical to claim 31. The only difference is the description of the heat sink. In claim 31 the heat sink is positioned in heat transfer relationship to said plurality of second thermocouple. In claim 37, the heat sink is provided on said substrate in close proximity to said second plurality of thermocouples.

As I indicated previously, Mr. Zimmermann is trying to show his struggle in trying to make the cold junctions temperature to be equal using a Heat spreader [i.e. Copper is a very efficient heat conductor] that he calls a heat sink [element 60 in figure 2 of Mr. Zimmermann].

If one uses a serially connected thermocouples and connect the cold junction by an isothermal block, as I indicated in my application on page 12 lines 9 and 10 from the top, then there is no need for such infinite trial and error method of trying to equalize the cold junctions temperature. Moreover, if the thermocouples are configured in parallel, the isothermal block is not needed since the same single cold junction is used for all the hot junctions.

New claim 34 Remarks :

Figure 3A in my application shows the difference in the temperature rise of the hot junctions when they are in air versus when they are in liquid.

New claim 35 Remarks :

To get the temperature rise of the hot junctions after power is applied, the voltage from the hot thermocouple junctions need to be subtracted from the voltage of the cold thermocouple junctions. If the ambient temperature is equal to the temperature of the cold junctions in a serially connected thermocouples , then and only then the cold junctions will generate a compensating signal indicative of ambient temperature. If the cold junction temperatures is significantly different than the ambient temperature, then the cold junction will not generate a compensating voltage indicative of ambient temperature.

New claim 36 Remarks :

In my application on page 12 lines 9 and 10 I suggested to use isothermal block to equalize the temperature of all of the cold junction. In this claim, Mr. Zimmermann is saying that if we put the heat spreader, which is made of Copper on the other side of the substrate, [but under the cold junction] then it will approximately act as a heat spreader. First, the heat spreader will never be as good as an isothermal block in equating the temperature of the cold junction. Second, if the substrate is not thin enough, probably less than 4 mil thick, then putting the Copper heat spreader on the back of the substrate , but under the cold junction, will not be as efficient in equating the cold junction temperature as putting it very close to the cold junctions.

New claim 37 Remarks :

In my application on page 14, 5 lines from the bottom, I wrote that the coating is electrically insulating. It is also clear that for the heat from the heater to go to the air and liquid, the coating needs to be thermally conductive. Besides, most materials that are very thin will let the heat go through it.

New claim 38 Remarks :

On page 26 , line 7 from the top, of my application, I wrote that the coating needs to be hydrophobic or oil phobic.

New claim 39 Remarks :

In figure 6, element 62 is an elongated resistance heater and when the Constantan , element 60 in figure 9 of my application is used as the heater, it is also an elongated resistance heater.

CHART FOR REDUCTION TO PRACTICE

1) The use of temperature profile along a heater

When I started inventing my sensor, I wanted to invent a low-cost multi-function liquid sensor that is self-calibrated and uses a low power. I looked at three-dimensional sensors like the capacitor technology and found that they have limitation on performance, space , cost and multi-functionality. I looked at point sensors and found out that they require the least space but they also require uniformity of the mediums in which they operate as well as other limitations. For example, a point sensor that uses ultra-sonic technology will change its accuracy based on the changes in the air density. Similarly, a point sensor, which uses optical technology, will not measure liquid level when a foam is present over the oil as in the use of compressors for refrigeration. In such a compressor, the reflective index on the foam is very close to the reflective index of the oil.

Based on this research, I realized that neither the three dimensional technology nor the point technology will give me a multi-function liquid sensor that is low-coat and self-calibrated. This was the first reason for choosing a line technology. One possible implementation of the line technology is the use of a heater. If I use a heater and do not want to heat the entire volume of liquid inside a container, then I will need to heat just the boundary layer around the heater. If I wanted to have the sensor self-

calibrated in the presence of localized errors, I needed to do a few things. First, average the localized errors over the entire length of the sensor. This is one reasons for using a few thermocouples along the heater. By taking a simultaneous reading from a few thermocouples, I can use a few methods to average the localized errors. One such method will use a numerical correlation between an ideal (nominal) curve and the measured discrete points.

These were a few reasons on how to get a low-cost multi-function liquid sensor that is self-calibrated and uses low power. The required main feature to achieve this goal is to use a temperature profile along a heater. The temperature profile is shown in Figure 3A of my application. This profile is made of three sections. Those sections are marked as 110, 111 and 112. Sections 112 and 111 can be tailored to be close to a flat horizontal lines. Line 110 is the wave like section. The bottom point of the wave touches line 111 and the top of the wave touches line 112. As the liquid level rises, the wave shape translate with the rising liquid level. The beginning of the wave will always be located where the liquid level is at. If one is interested in measuring continuous liquid level accurately and self-calibration, then by looking at a few points along the wave, one can tell where the wave begins.

To generate a temperature profile as shown in Figure 3A, I used a heat transfer mechanism that used convection of heat to the liquid and air in combination of conduction along the heater. [see page 4, lines 7 to 9 from the top of the page].

Mr. Zimmerman uses the temperature profile along the heater as shown in my figure 3A. He disguised this use by plotting his figure 3 as a method for determining the liquid level. Figure 3 of Mr. Zimmermann is obtained by adding the temperature rise from the six thermocouples instead of showing the temperature rise from each thermocouple and the entire temperature profile.

2) Type of Thermocouples

In the first proof of concept (see test results in Figure 8) , I used a set of identical six thermocouples. One leg was Aluminoil and the other one was made of Chromaloil. To reduce the production cost and get thermocouples that do not need calibration, I needed to use thermocouple made of a Copper and Constantan. The Copper is available on the substrate and the alloy called Constantan is not expensive. Moreover, this kind of thermocouples is not sensitive to a wide range of temperature. In other words, if a temperature rise (voltage) of 10 degree C measured at room temperature of 50 degree C is 400 microvolt then 10 degree C at ambient temperature of 80 degree C will also be 400 microvolt.

3) Coating

In 1996 and 1997, I conducted tests with a Kapton sheet as a coating. Because the Kapton absorbs some liquid and in Diesel also builds a thin layer over it, I realized that the coating needs to be hydrophobic as I described on page 26 line 7 from the top in my application. This is why in subsequent tests, I used a Teflon coating.

4) Pressure measurement.

When I was developing a fuel level sensor, I was asked to find a replacement for the present method of detecting pressure leakage from a fuel tank. When I realized that the density of the compressed fluid might dominate the heat transfer coefficient for compressible fluid , I invented the approximate method of detecting pressure leakage which I described on Page 27 line 3 from the top in my application.

Conclusion

The Applicant now believes the application to be in condition for examination, and respectfully requests that a timely interference proceeding be instituted in this case. Should the Examiner have any questions regarding this response or need any additional information, please contact the undersigned at (310) 274-1434.

Respectfully submitted,

J. Maatuk

Date :3/24/06

Josef Maatuk
Pro-Se Inventor
(310) 274-1434

that question first.

Q Who -- do you know who is listed on the patent application as the inventor?

A A number of employees from Therm-O-Disc are listed on the patent.

Q Are you one of those employees?

A I am not.

Q Who are those employees?

A I might not have all the names.

Q Which are the ones that you have?

A Mr. Zimmermann would be one of them.

Q So would you say in your position as director of new products and technology, is that correct?

A Yes.

Q Would you say in your position as Therm-O-Disc's director of new products and technology that Mr. Zimmerman is more knowledgeable than you concerning Therm-O-Disc's liquid level sensor technology?

A Mr. Zimmerman is the person who is working directly on developing the technology. In that capacity he works with the technology more frequently than I do. As his supervisor, I'm knowledgeable of technology that is being developed.

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Q Did you personally send him one?
A I do not recall.
Q Do you know if you spoke to Dr. Maatuk before a confidentiality agreement was sent out?
A I could not be certain of that but I would not be surprised.
Q I would like to show you what's going to be marked as Exhibit 1. And that is what purports to be a confidentiality agreement between Therm-O-Disc and Max Em Engineering.
Do you know what Max Em Engineering is?
A That is the business form of Dr. Maatuk.

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(Khadkikar Exhibit 1 was marked.)

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MR. UTYKANSKI: Go ahead and review that.
Q Now, have you seen this actual proposed confidentiality agreement before?
A Yes, I have seen this type of document, yes.
Q No, I understand that, because it says at the bottom this is a Therm-O-Disc form, 1647.
A That's correct.
Q My question is, have you seen this actual proposed confidentiality agreement between

Therm-O-Disc and Max Em Engineering?
A I believe I have.
Q Now, directing your attention to paragraph 3B. Prior to the 26th of June 1998, did Therm-O-Disc have in development or produce multiple thermocouple liquid level sensors?
A Would you repeat that question?
Q Sure.
Prior to the 26th of June, 1998 --
A Yes, yes.
Q -- did Therm-O-Disc -- I'll have to ask another question.
Did Therm-O-Disc produce multiple thermocouple liquid level sensors?
A No, we did not.
Q Have they done any research into multiple thermocouple liquid level sensors?
A Not to my knowledge.
MR. UTYKANSKI: The last question relates to the same time frame?
MR. GLICKER: Yes, yes.
MR. UTYKANSKI: Okay.
MR. GLICKER: Prior to June 26, 1998.
Q Obviously, prior to writing this down, somebody

must have looked at something to say, Max Em has an idea for a multiple thermocouple liquid level sensor, otherwise that wouldn't be written down.
Do you know who that was?
A No, I do not know who that was.
Q Do you have an understanding of whether this confidentiality agreement was ever signed?
A Yes. It is my understanding that it was signed.
Q By both Therm-O-Disc and Max Em?
A That is correct.
Q So at some point subsequent to the 26th of June 1998, Therm-O-Disc and Max Em jointly evaluated the new features for a multiple thermocouple liquid level sensor; is that correct?
A That is correct.
Q And who at Therm-O-Disc did that evaluating?
A It was done under my supervision in our group.
Q Was a prototype made under your supervision?
A Yes, a prototype was made.
Q And the prototype was used for testing?
A Yes.
Q And you received test results?
A Yes.
Q Did you have those test results analyzed?
A Yes.

Q If we're talking about the prototype that was made, was the prototype made per the specifications in the patents?
MR. UTYKANSKI: I'm going to object to the form of the question as vague and ambiguous.
MR. GLICKER: Okay.
MR. UTYKANSKI: To the extent you understand it --
Q I'll rephrase the question.
On what basis did you supervise the making of a prototype?
A Can you say that again?
Q Sure. I'll try and do it better. The third time's a charm.
When you built a prototype, you used certain materials, certain processes, correct?
A Yes; that is correct.
Q How did you know what materials and processes to use?
A The first prototype that we built that was -- the information was received from Dr. Maatuk for that prototype.
Q Was there a second prototype?
A Yes, there was a second prototype.

APPENDIX A 2 of 2

CONFIDENTIALITY AGREEMENT

This Confidentiality Agreement is made and entered into this 12 day of DECEMBER 1997 by and between MAX EM and Therm-O-Disc, Inc. (hereinafter referred to as "Therm-O-Disc").

Purpose of Agreement

1.) It is the intention of the parties to set forth the terms by which certain proprietary or confidential MAX EM LIQUID SENSOR information provided to Therm-O-Disc, shall be maintained and returned to MAX EM such that it will remain confidential and will not be disclosed to any parties or entities not party to this Agreement.

Disclosure of Confidential Information to Therm-O-Disc

2.) In consideration of the obligations of Therm-O-Disc as set forth below, MAX EM agrees to provide certain proprietary or confidential information to Therm-O-Disc. MAX EM agrees that any such information shall be designated as "Proprietary" or "Confidential".

Obligations of the Recipient

3.) In consideration of the obligations of MAX EM as set forth in the Agreement, Therm-O-Disc agrees:

(a) That all Proprietary or Confidential information provided to it by MAX EM shall be maintained in strict confidence and will not, without the prior written consent of MAX EM be disclosed to any third parties;

(b) That the Proprietary or Confidential information will be used solely for the purpose of EVALUATE THE MAX EM LIQUID SENSOR TECHNOLOGY FOR POTENTIAL LICENSING TO THERM-O-DISC

(c) That it will instruct all employees to whom it has discussed or revealed any Proprietary or Confidential information that the information is not to be disclosed to third parties outside of Therm-O-Disc.

APPENDIX B

(d) That it will use the same degree of care in safeguarding the Proprietary or Confidential information as it uses in safeguarding its own proprietary or confidential information.

(e) That it will return all Proprietary and Confidential documents to MAX EM, including any notes, reports, summaries, and other records regarding the contents of the Proprietary and Confidential documents if requested to do so by MAX EM in writing. (If any Proprietary and Confidential information is commingled with proprietary and confidential information of Therm-O-Disc, Therm-O-Disc shall have the option of destroying the Proprietary and Confidential Information, or redacting the Proprietary and Confidential information of MAX EM from these documents and shall confirm in writing to MAX EM that it has done so.)

Definitions

4.) Proprietary and Confidential Information shall include all information designated as Proprietary and Confidential by MAX EM including without limitation confidential financial information, confidential competitive information, trade secrets, or any other proprietary and confidential information of MAX EM, including, but not limited to, information regarding the design, testing, construction or manufacturing processes of any MAX EM product, information regarding the materials used in the product, or information relating to the composition of materials used in the product.

5.) Confidential information will not be deemed to include information which:

(a) at the time of disclosure to Therm-O-Disc is generally available to the public or thereafter, without any fault of Therm-O-Disc, becomes generally available to the public by publication or otherwise;

(b) was in the possession of Therm-O-Disc prior to the time of disclosure to Therm-O-Disc or could have been obtained by Therm-O-Disc based on information in the possession of Therm-O-Disc at the time of disclosure;

(c) was independently made known to Therm-O-Disc by a third party not under any obligation or secrecy of confidentiality to MAX EM or

(d) is specifically released to Therm-O-Disc by MAX EM in a written instrument to the extent and for the purposes set forth in such instrument.

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6.) If Therm-O-Disc is compelled by legal processes to disclose any MAX EM LIQUID SENSOR information, Therm-O-Disc will use its best efforts to obtain a protective order for such documents in accordance with the terms of this Agreement and will give MAX EM as much advance notice as possible and, allow MAX EM the opportunity to intervene in such action, if necessary, and obtain an appropriate confidentiality agreement or protective order.

7.) This Agreement constitutes the entire agreement between MAX EM and Therm-O-Disc with respect to the Proprietary and Confidential information of MAX EM LIQUID SENSOR

8.) This Agreement may not be changed orally, but only in writing, signed by both MAX EM and Therm-O-Disc.

9.) This agreement shall terminate within 4 years after the completion of the project described in section 3b.

10.) The parties to this agreement represent and warrant that the individuals signing this agreement on their behalf have authority to do so.

11.) This Agreement shall be governed and construed in accordance with the laws of the state of Ohio.

AGREED TO AND ACCEPTED:

RECIPIENT J. Maatuk	THERM-O-DISC, INC.
By MAX EM ENGINEERING	By [signature]
Name JOSEF MAATUK	Name Bernard S. Denser
Title OWNER	Title VP Quality & Technology
Date 12.5.97	Date 12/15/97

APPENDIX B

P.4
DEC 02 '97 03:33PM THERM O DISC

THERMODISC
50 YEARS • 1947-1997

June 17, 1998

Dr. Joseph Maatuk
MaxEm Engineering
P.O. Box 351055
Los Angeles, CA 90035

Dear Joe:

As discussed, we are in the process of specifying the liquid level sensor probes to Sheldahl. Sheldahl has offered to supply some prototypes to Therm-O-Disc as soon as they receive our CAD drawings, of which I have attached a draft for your review.

Initially, Sheldahl will not be able to place the constantan strip on the probe. However, we feel that we can attach the constantan wire to the copper traces using special welding techniques. As mentioned, the constantan wire diameters we are currently considering range from 5 to 12 mils.

Joe, please review the attached drawing and provide me your comments before I send it to Sheldahl early next week. I'm hoping that Sheldahl will be able to provide samples within 2-3 weeks after they receive the probe design.

Best regards,

Bernd Zimmermann

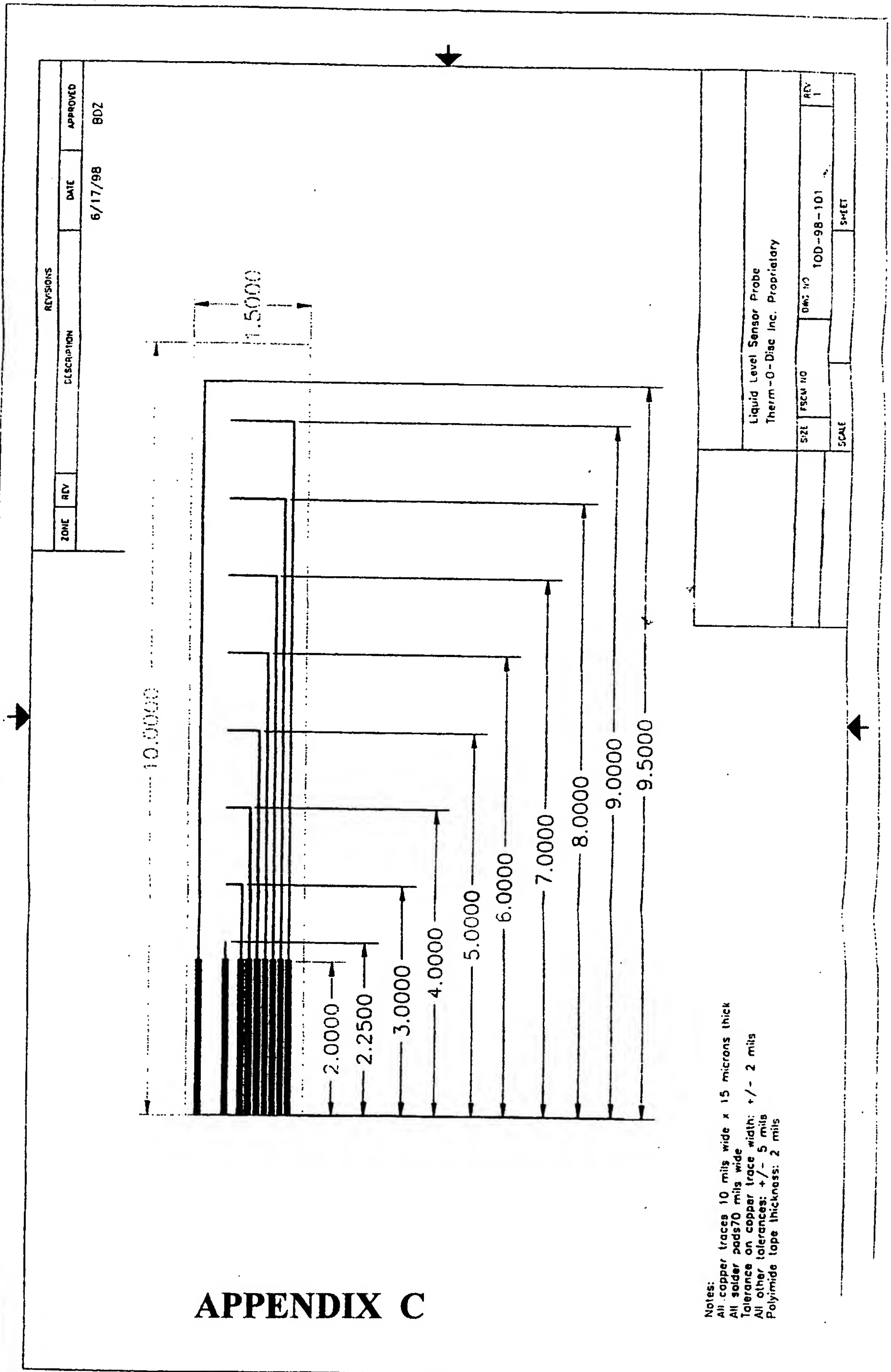
Bernd Zimmermann
R&D Engineer
Advanced Technology

cc: Prasad Khadkikar

EMERSON

THERM-O-DISC, INCORPORATED
SUBSIDIARY OF EMERSON ELECTRIC
1320 SOUTH MAIN STREET
MANSFIELD, OHIO 44907-0538
(419) 525-8500 FAX: (419) 525-8365

APPENDIX C



APPENDIX C

2 OF 5

MAX EM ENGINEERING
Pro-Active Products
Electronic • Mechanical

6/18/98

Dr. Prasad S. Khadkikar
Manager, Advanced Technology
THERMODISC, Inc.
1320 S. Main St.
Mansfield, Ohio 44907

Dear Dr. Khadkikar,

Thank you for having Bernd send me the probe drawing that he intends to send to Sheldahl. I will address the technical issues of the drawing with him. In this letter I wish to bring to your attention the fact that the drawing states that the probe design is the property of Thermodisc. Before Thermodisc signs a licensing agreement with Max Em, our liquid sensor design is the property of Max Em. I would like your drawing to Sheldahl to indicate that Sheldahl is getting a confidential information and that the design is owned by Max Em.

Concerning our progress, we hope that the potential licensee in the San Francisco area will make their decision the first or second week in July. In the meantime, this potential licensee has gotten the fuel level specifications for the automotive market, we had three meetings to discuss the different development and production issues with my associates and suppliers and they also allocated a program manager and a material production engineer to start working on this project. Their patent department has 15 patent attorneys that want us to agree to widen the claims in our patent after we sign a licensing agreement.

Yesterday I also talked to our rep in Detroit and asked them to line up OEM lab or first tier supplier labs that will do for us two tests. One is the fuel soaking test. Two, vapor leakage test. Once I line up those labs, I will provide first a probe for the soaking test and then a probe for the vapor leakage tests. I will be in Detroit, the week of July 13 to discuss those tests and see a couple of potential licensees. One of those automotive suppliers is Pollak that has their VP of business development fly from Connecticut to meet me in Detroit. Next week, we will get a specification from Barksdale Controls for marine applications. After that, we will make a licensing agreement with them.

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During the writing of this letter, I got a call back from Walbro and basically, they will freely check for fuel soaking the next probe that we build. I hope to have this probe ready by the time I go to Detroit on July 13. I am also looking into finding a lab that will test our probe for vapor leakage.

That is about every thing that is happening. I will keep you posted on the licensing and the technical developments that we are making.

Very Truly Yours,

Josef Maatuk, Ph.D., P.E.

P.O. Box 351055 • Los Angeles . California 90035 • (310) 652-1434

APPENDIX C

THERMODISC
50 YEARS • 1947-1997

June 24, 1998

Dr. Joseph Maatuk
MaxEm Engineering
P.O. Box 351055
Los Angeles, CA 90035

Dear Joe:

This is a follow-up to your letter dated 6/22/98 and our phone conversation earlier today. As you had requested, we have changed the header in the title block of the CAD drawing for Sheldahl to read "Therm-O-Disc Inc. Confidential Information" as opposed to "Therm-O-Disc Inc. Proprietary". The drawing was sent to Sheldahl today, and we hope to have the probe samples built within 2 - 3 weeks after the engineers at Sheldahl have appoved the design for manufacturability.

Additionally, I wanted to reassure you that any MaxEm proprietary information which was provided to T-O-D in confidence will not be shared with Sheldahl (or any other third party) unless we have your prior written consent, as agreed upon in our Confidentiality Agreement with Max Em. I also wanted to confirm that a Confidentiality Agreement has been signed between Sheldahl and T-O-D to protect any confidential information related to the liquid level sensor.

Joe, I look forward to continue working with you on the evaluation of the Max Em liquid level sensor technology. Please call me at (419) 525-8502 if you have any other questions.

Best regards,

Bernd Zimmermann

Bernd Zimmermann
R&D Engineer
Advanced Technology

cc: Prasad Khadkikar

EMERSON

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SUBSIDIARY OF EMERSON ELECTRIC
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APPENDIX C

MAX EM ENGINEERING
Pro-Active Products
Electronic • Mechanical

3/29/98

Mr. Bernd Zimmermann
R & D Engineer
Therm-O-Disc
1320 S. Main Street
Mansfield, Ohio 44907

Dear Bernd,
Thank you for sending me your test matrix last Friday. The test matrix appear almost OK for the soaking test. It might also be OK for the EMI tests. However, for the design with five wires and increased SNR it will require additional development efforts.

Here are some of my comments :

1) Probe coating : The top layer need to be as thin as possible, otherwise, the thermal mass of the Teflon will reduce the signal.

2) Spacing between junctions : If you place them 1 inch apart, you will have 7 traces instead of 5.

3) I would like to get the chemical composition of the Teflon, Kapton and adhesives that will be used in the soaking tests before we do the soaking tests.

4) Concerning SNR : If we use our sensor as a stand alone sensor then we get a very good reading of the level for the present signal level.

   If we need to use the microprocessor and the A/D converter that Walbro uses for their fuel pump, then we will need to change the electronic hardware that we have to get a higher signal level.

5) # of Copper traces : To give you accurate level reading for a 6 inch probe with 5 wires, we need to do more studies and developments. Essentially, by increasing the signal and spreading it, we will be able to achieve this goal. If we can insulate the sides and the bottom of the heater and also change the ratio of convection to conduction area, then we will be able to start the first tap about 1 inch below the top of

APPENDIX D

the fuel tank and the fifth Copper trace, 1 inch above the bottom of the fuel tank. Additionally, in order to use the connection of The Copper traces to the heater as a thermocouple joints, additional work needs to be done. Once such work is completed, most likely, we will be able to get the fuel level reading with 5 taps whereby the first tap start about 1 inch below the top of the fuel tank and the last (fifth) tap is 1 inch above the bottom of the tank.

These are the important points that I wanted to run by you. After your review, if you have any question, feel free to contact me.

Very Truly Yours,

Josef Mastuk, Ph.D., P.E.

P.O. Box 351055 • Los Angeles . California 90035 • (310) 652-1434

APPENDIX D

2 OF 5

MAX EM ENGINEERING

Pro-Active Products
Electronic • Mechanical

4/19/98

Dr. Prasad S. Khadkikar
Manager, Advanced Technology
THERMODISC, Inc.
1320 S. Main St.
Mansfield, Ohio 44907

Dear Dr. Khadkikar,

Thank you for your time on the phone last Thursday discussing your interest in our multi-function liquid sensor.

In this letter, I will describe the two subjects that we discussed on the phone. First, developing a slightly modified prototype. Second, start putting on papers our business expectations and ideas for licensing our multi-function liquid sensor to Thermodisc.

We propose to develop a slightly modified sensor that will use the existing electronic hardware together with a probe that will be specified by Max Em and supplied by Thermodisc. Max Em will adapt the existing level sensing Software to display three things for fuels :

1) Liquid Level for a set of fuels. The set should not exceed 7 types of fuels.

2) a measure of the fluid or specifically fuel temperature

3) a measure of the thermal properties of the fuel that is expected to represent the kind of fuel.

We propose that Thermodisc will select the method of production and the material for the probe that will easy and cheap to produce while getting more of the heat to the liquid (in comparison to the existing Kapton as a material and lamination as the method of production).

APPENDIX D

We also suggest that Thermodisc develop at least three probes that will allow the variations of the high, low and medium values of some of the probe parameters. At least Thermodisc should consider the vacuum deposition together with lamination as possible methods of productions.

Based on the method of production and material of the probe that Thermodisc select and the probe that you provide, we expect a proper signal to noise ratio. Since we really do not know how good the signal to noise ratio will be, we can only do our best for giving you a prototype that you can use in a lab to demonstrate that is can determine continuously liquid level, temperature and the kind of fuel.

The development cost for our efforts will be $ 30,000 and it will take us 10 to 12 weeks to complete it, assuming that Thermodisc will supply the probe within 2 to 3 weeks after we give you the specifications. The first payment will be $ 18,000 at start of work and the $ 12,000 will be paid after meeting some defined milestones but 2 weeks before delivery of the 3 function prototype.

Once you demonstrate the proof of concept in a lab environment, you will be able to adapt it to different designs like 5-wires of Walbro which will probably be a limited application as well as the generic application. To make the 12 wires design measure the 3 fluid parameters with 5 wires only will probably require additional developmental effort of $ 50,000 and 4 to 6 months time.

The second point of this letter will describe our ideas on a licensing agreement between Thermodisc and Max Em. For our business relationship to work, Thermodisc will need to make three commitments. First, allocate resources to capture a share of an automotive market within a given time. Second, Thermodisc allocates resources to productizing the probe and develop the ASIC for our multi-function liquid sensor. Third, allocate funding for Max Em developmental efforts.

Concerning the marketing efforts and market penetration, we would like to work with companies that can capture 15 to 20 percent share of the market so that we give those companies exclusive rights. For companies that capture smaller market share we intend to offer our technology on a non-exclusive basis. In the present automotive market, our multi-function technology can be used for fuel, engine oil, coolant and brake fluids. In the future automotive systems that I anticipate them to be pro-active (instead of present automotive systems that use reactive feedback), our sensor can be used for other purposes too.

We strongly believe that the best way to penetrate the automotive market, will be in the fuel sensing market. Giving you a proof of concept for fuel level, temperature and kind of fuel is doable relatively quickly. Giving you a proof of

APPENDIX D

concept for detecting vapor leakage can take between 6 to 12 months and will cost close to 100 K in development cost. However, once it works with our technology, you will eliminate the $ 6 air pump and the $ 12 calibrated pressure sensor that are used today to detect vapor leakage.

We can start developing the 3 function probe within a one week notice. We can start negotiating the licensing agreement while we are developing the 3 function probe and your company is getting the specifications for the specific markets in the US or South America.

We are talking to other companies that already have a small market share in the heavy trucking market and have an interest in getting a license to increase their market share. The heavy trucking market appear as a possible application whereby a multi-function oil sensor will be bought by the truck fleet for a high price. In particular, measuring oil acidity, viscosity and liquid contaminants. Again, only your marketing people can get the accurate information on what the truck fleet companies will pay for a multi-function automotive liquid sensor.

I hope that this letter clarifies the desired characteristics of a licensing agreements that we are looking for. If you have any question, feel free to contact me. Thank you again for your time on the phone and interest in moving forward toward a possible licensing agreement.

Very Truly Yours,

Josef Maatuk, Ph.D., P.E.

APPENDIX D

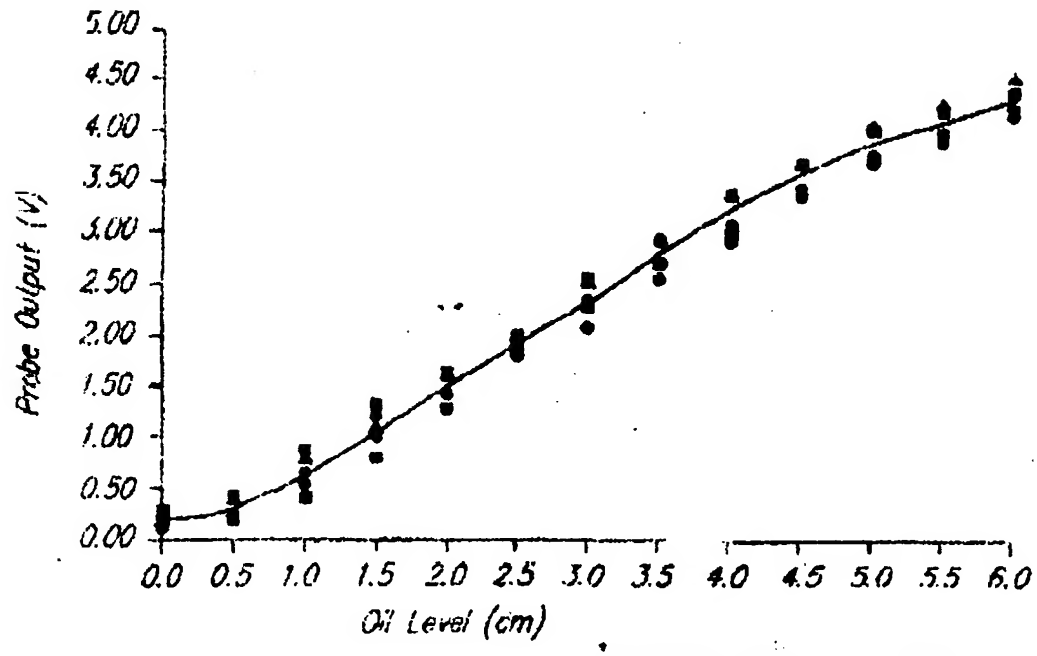

FIG. 3.

APPENDIX E

1 of 2

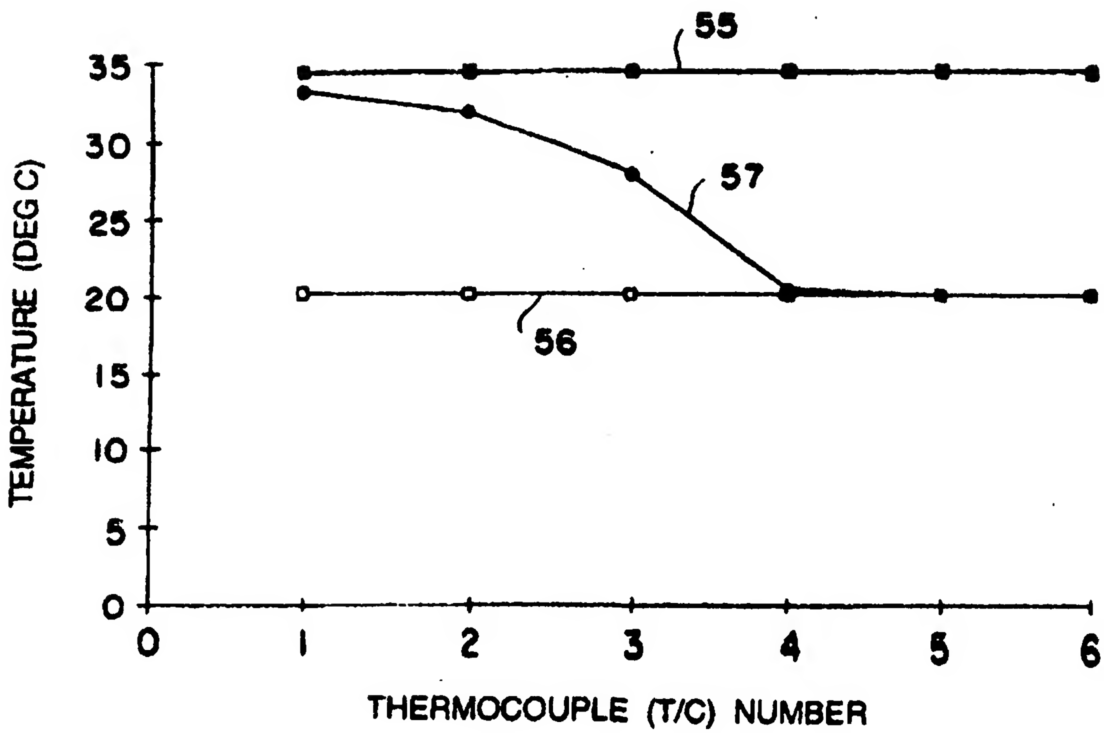

FIG.3

APPENDIX E

Zimmermann, Bernd

From: Zimmermann, Bernd
Sent: Friday, April 30, 1999 11:45 AM
To: 'Joe Maatuk'
Cc: Khadkikar, Prasad; Fisher, John
Subject: Compressor Data for Liquid Level Sensor

Joe:

Attached is the data file containing the liquid level sensor results we spoke about. It is a compressed, self-extractable MS Excel file (Office '97 format). By double clicking on the Matuuk.exe icon, it will place a copy of the uncompressed file (Matuuk.xls) on your hard-disk. If you have any questions about opening the file in Excel, please let me know, and I'll send you the floppy disk.

You will see that the data does not include any information about the absolute level of the oil in the compressor. The level was changed in discrete steps from "full" to "empty", a range of approx. 6.0 cm. The spacing of the four thermocouple junctions is approx. 15 mm. The x-axis data is units of seconds, while the y-axis data is in units of Volts (output of each thermocouple). The chart labeled "BaselineChartB" represents the data obtained when the compressor is turned off, as oil is drained in discrete levels. The output of each thermocouple changes by as much as 0.5 mV as the oil level changes. What concerns us is that under certain operating conditions, when the compressor is turned on (see "45l85l65ChartB", for example), the output of each thermocouple changes only by 0.2 mV or less as the oil level changes by the same amount as in the baseline test. We are speculating that this may be attributed to the agitation ("sloshing") of the oil inside the compressor shell, although there are many other variables (pressure, temperature, etc) which are dependent on the operating condition of the compressor.

We would appreciate your input/feedback on this data set, and any recommendations you might have in this respect. Please be aware that this data is T-O-D/Copeland confidential, and should not be shared with anyone outside MaxEm.

Best regards,

Bernd

APPENDIX F